

AN IMPERFECT SKELETON OF *YOUNGINA* *CAPENSIS*, BROOM, IN THE COLLECTION OF THE TRANSVAAL MUSEUM

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IN January, 1913, I discovered at New Bethesda, Cape Province, the very fine skull which I made the type of *Youngina capensis*. This little reptile is one of the most important discoveries of recent times as it is the most primitive two arched skull known. Quite a number of Diapsidon skulls of various types have been known from the Trias beds of Europe, America and Africa, but *Youngina* is the only known type with a two-arched skull occurring in Permian beds, and as might be expected, it is more primitive in structure than any of the later types. It has a long pointed beak with numerous Thecodont teeth; and there is no preorbital vacuity. The posterior part of the skull is in general appearance *Sphenodon*-like with a small supra temporal vacuity and a larger infra temporal. There is a large pineal foramen. But *Youngina* is remarkable in retaining a distinct tabular bone and also an interparietal. The squamosal is larger and the quadrato-jugal small. Differing so greatly from all previously known forms *Youngina* becomes the type of not only a new family *Younginidae*, but indicates a new Order which I have called the *Eosuchia*.

The *Eosuchia* is probably the ancestral order from which not only *Sphenodon*, Crocodiles, Pterodactyles and Dinosaurs have been derived, but possibly also contains the ancestors of modern lizards. *Youngina* being thus such an extremely interesting type it is of the utmost importance that we should know something more of it than merely the skull. The type skull was associated with a number of vertebrae but nothing was known of the limbs or girdles.

Fortunately, a few years ago Mr I. Venter, then a teacher at New Bethesda, discovered an almost perfect skeleton within a few yards of the spot which yielded the type. Most regrettably, however, he removed the remains in a very unskilful manner and what was apparently a complete skeleton is now merely a few fragmentary bones with very few contacts remaining. These remnants are now in the Pretoria Museum. Still, though much has been lost, the remaining fragments tell us quite a lot. The only perfect bones to be seen are the right tibia and the left tarsus and some vertebrae, but there is a nearly perfect left humerus, and portions of quite a large number of other bones.

The skull is represented by little more than the maxillae premaxillae and dentaries with most of the palate. This shows *Youngina* to have a longer and sharper snout than was believed to be the case before—the front of the snout being lost in the type. There appear to be three teeth in the premaxilla and about 20 in the maxilla. The palate is imperfectly seen on its upper side. It is apparently of the Rhynchocephalian type with long pterygoids.

The lower jaw is a little like that of the Crocodile but has no lateral opening and the angular and splenial bones are much more developed. The lower jaw and the palate are rather better preserved in a third skull which I found at New Bethesda two and a half years ago, and which will be described in greater detail elsewhere from this third specimen.

There are quite a large number of vertebrae, but only a few series of three or four, and these are mostly imperfect. All the vertebrae are completely notochordal. In general appearance so far as can be seen they are lizard-like, but all the dorsal vertebrae at least have large well ossified intercentra. The caudals are remarkable in being much elongated and without chevrons.

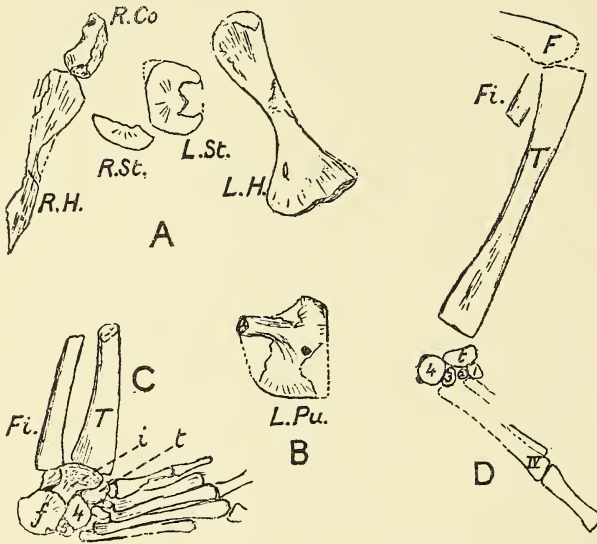


Fig. 1. Skeletal remains of *Youngina capensis* Broom. Nat. size.

- A. Pectoral region showing sternal plates (*R.St.* and *L.St.*), both humeri (*R.H.* and *L.H.*) and imperfect right coracoid (*R.Co.*).
 B. Imperfect left pubis.
 C. Left hind foot showing the plantar aspect: *T*, Tibia; *Fi.*, Fibula; *t*, tibiale; *f*, fibulare; *i*, intermedium; 4 and 5, tarsalia.
 D. Imperfect right hind limb, showing the dorsal aspect: *F*, Femur; *Fi.*, Fibula; *T*, Tibia; *t*, tibiale; 1, 2, 3, 4, tarsalia; *IV*, 4th metatarsal.

The shoulder girdle is badly preserved, but is of the *Sphenodon* type. The coracoid is relatively smaller and the scapula more rod-like than in the living Diapsid. Nothing of any importance remains of the clavicles and interclavicle, but there is clear evidence of two large flat bones in the pectoral region. These are pretty manifestly sternal ossifications.

The humerus is well preserved. The head is small and there is a fairly well developed delto-pectoral crest. The distal end is wide. There is an entepicondylon foramen. The radius and ulna are imperfectly preserved. Nothing is seen of the carpus, but the digits are seen to be long and slender.

Of the pelvis only a badly preserved pubis remains and a few unimportant fragments of the other bones. The pubis, as will be seen from

the figure, is not unlike that of *Howesia*, and quite manifestly the pelvis has been plate-like.

The femur tibia and fibula call for no special remark. They are all long slender bones with little in the way of muscular impressions. The tibia measures 35.5 mm.

The tarsus is fortunately perfectly preserved on the left side and part of the right one is also to be seen. It is the finest early Diapsid tarsus known, and one of the most important ever discovered. There is a large proximal element which I have elsewhere shown to be the intermedium and not the tibiale as generally believed, and a smaller proximal element, the fibulare, which forms a heel process. The intermedium has a very large articular surface for the tibia and a smaller articular surface for part of the fibula. The outer part of the intermedium is twisted somewhat forward so that when the tarsus is seen on the plantar surface this outer part is sunk in and looks at first like an additional element. There is a small foramen between the intermedium and the fibulare. The fibulare is a rounded flat bone only thickened where it articulates with the inner elements. It gives an articulation for part of the fibula. There is a fairly large tibiale which possibly gives a small articulation to part of the tibia when the foot is flexed. There are five distal tarsals. The first, second and third are relatively small, but the fourth is large and rather firmly articulated with the intermedium and fibulare. There is a distinct and moderately large fifth tarsal which is closely articulated with the fibulare and the fourth tarsal. The metatarsals are all well developed and flattened rod-like bones. They increase in length from the first to the fourth. The fifth metatarsal is particularly interesting in that it shows no evidence of the peculiar hooking met with in the fifth metatarsals of *Sphenodon*, lizards and most allied forms of reptiles. In the specimen it is slightly imperfect but the proximal end is practically perfect and there is preserved the impressing of the distal end, so that the bone may be regarded as fully known. It is a little shorter than the first metatarsal and like it is only very slightly curved. The proximal end is much flattened and there is an outer process which was doubtless attached by a ligament to the fibulare.

The striking points in the structure of *Youngina* are the remarkable skull, the sternum and the primitive tarsus and metatarsus.

The skull is primitive enough to be ancestral to that of the lizards, *Sphenodon*, and all the later two arched types. The presence in it of a tabulare is particularly interesting. A tabulare is found in all the very primitive reptiles and is constantly retained in the mammal-like reptiles. In the phylum which gave rise to the two arched forms it becomes early lost. It is still retained in *Ichthyosaurus* and in the lizard-like *Araeoscelis* and in a few of the later two arched reptiles such as *Sauranodon* and probably *Pleurosaurus*, and in many lizards. *Youngina* shows us what is probably the ancestral condition in the two arched reptiles, and in the lizards which have been derived from them.

The shoulder girdle is almost typically *Sphenodon*-like. But it is remarkable in retaining or possessing an ossified sternum. Ossified sterna are very rare in reptiles, but cartilaginous sterna are almost always present. The two flat sternal plates are strikingly like the sternal plates found in many Dinosaurs, and the ossifications in the sternum of Struthious birds.

It is probably the oldest true ossified sternum known. Watson believes he has discovered a sternum in "*Seymouria*"—"the first evidence of an ossification in this element in a Lower Permian Reptile." For various reasons I differ from Watson as regards the affinities of "*Seymouria*," and believe it to be an Embolomeroous Amphibian. The ribs are quite unlike the ribs of any reptile, and it seems to me more probable that the element discovered by Watson is the homologue of the Xiphisternum of the frog and not a true costosternum. If this be so the sternum of *Youngina* would be the earliest known true sternum.

The tarsus and metatarsus are exceptionally interesting. Only a few years ago Goodrich called attention to the importance of the tarsal and metatarsal condition as throwing much light on reptilian classification. He divided the later reptiles into two branches—those with simple metatarsals and those with a specialised fifth metatarsal. It had long been known that *Sphenodon* lizards and Chelonians have a peculiarly hooked fifth metatarsal. In Goodrich's opinion such a peculiarity is not likely to have been twice evolved, and if that be so those forms with this specialisation must be closely related. The discovery of a two arched reptile with a simple fifth metatarsal must mean, if Goodrich's opinion be correct, that the Chelonians are derived from a two arched reptile like *Sphenodon* with remarkable specialisations of the skull. The other alternative is that the Chelonian fifth metatarsal has been independently evolved and come to resemble that of *Sphenodon* by a parallel development. Personally, I favour the latter alternative.